

Health and Safety Plan

**Lockformer
711 W. Ogden Avenue
Lisle, Illinois**

Prepared for:
THE LOCKFORMER COMPANY
Lisle, Illinois

Prepared by:
CLAYTON GROUP SERVICES, INC.
3140 Finley Road
Downers Grove, Illinois 60515
630.795.3200

Clayton Project 15-65263.01

December 2001

US EPA RECORDS CENTER REGION 5



420996

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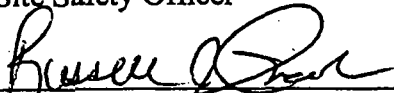
December 2001



William S. Elwell
Site Safety Officer

12-5-01

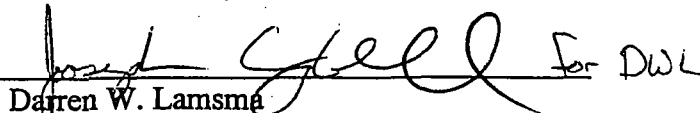
Date



Russell J. Chadwick
Health and Safety Officer

12/5/01

Date

 For DWL

Darren W. Lamsma
Alternate Site Safety Officer

12/5/01

Date

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- C Lock Out / Tag Out Acknowledgement Form

ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
CHRIS	Chemical Hazards Response Information System
Clayton	Clayton Group Services, Inc.
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
eV	Electron-volt
HASP	Health and Safety Plan
MSDS	Material Safety Data Sheets
NIOSH	National Institute for Occupational Safety and Health
OHSO	Office Health and Safety Officer
OSHA	Occupational Safety and Health Administration
PHSO	Project Health and Safety Officer
PID	Photoionization detector
PM	Project Manager
PPE	Personal protection equipment
PPM	Parts per million
SHSO	Site Health and Safety Officer
SRH	Soil Resistive Heating
SVE	Soil Vapor Extraction
TRS	Thermal Remediation Services
USCG	United States Coast Guard

1.0 GENERAL INFORMATION AND SCOPE OF WORK

The Lockformer Company (Lockformer) has retained Clayton Group Services, Inc. (Clayton) to conduct further site investigation and remediation activities at the Lockformer facility located at 711 W. Ogden Avenue in Lisle, Illinois. Figure 1 shows the location of the subject property.

This Health and Safety Plan (HASP) describes the general procedures that are to be implemented to protect Clayton and its subcontractors involved with field investigation and remedial activities to be conducted at the Lockformer property.

1.1 PROJECT DESCRIPTION

The proposed principal field activities to be conducted include:

- Drilling soil borings
- Collecting soil samples from borings
- Installing groundwater monitoring wells
- Developing wells
- Measuring groundwater elevations
- Collecting groundwater samples
- Performing slug tests
- Surveying
- Treatment of impacted soil by Soil Resistive Heating (SRH)
- Soil Vapor Extraction (SVE)
- Possible earthmoving/excavation activities

1.2 SITE LOCATION, HISTORY, AND CURRENT CONDITIONS

The Lockformer property is located at 711 W. Ogden Avenue, within the city limits of Lisle, in DuPage County, Illinois. The property is located within the southeast $\frac{1}{4}$ quarter of the southeast $\frac{1}{4}$ quarter of the southwest $\frac{1}{4}$ quarter of Section 2, Township 38 North, Range 10 East, in Lisle, Illinois.

The eastern portion of the property is developed with a partial two-story office / manufacturing building. The subject building is a rectangular-shaped structure utilized for the manufacture of sheet metal processing equipment and roll forming machines. The subject building contains approximately 88,000 square feet of area and is constructed of masonry and metal truss atop a concrete slab foundation. A partial basement is located under the office portion of the building. A grassy landscaped area is located at the northernmost portion of the property, adjacent to Ogden Avenue. Asphalt parking lots are located at the north and west ends of the building, and an asphalt drive and truck dock is at the northeast portion of the property. A grassy area is at the rear of the building. A water reservoir for back-up sprinkler purposes and an onsite water well used in the manufacturing process are located at the northeast corner of the building. The west portion contains approximately 11.3 acres of undeveloped land and is located immediately west of the parking areas.

The site and surrounding area were developed in approximately 1940; however, construction of the onsite building was completed by March 1969. Soil was excavated during the reconstruction of Ogden Avenue and used as fill material on the subject property. The excavation and fill activities took place in the 1960s.

According to available information, the subject property was originally owned and developed by Lambertsons Sheet Metal Machinery. Beginning in 1979, Fronimac owned the property for a span of two years, before it was purchased in approximately 1982 by MetCoil Systems Corporation (MetCoil). The Lockformer Company is a subsidiary of MetCoil.

1.3 PROJECT SAFETY REQUIREMENTS

1.3.1 Personnel

Clayton personnel responsible for the health and safety of Clayton employees on this project include:

- | | |
|--|---------------------|
| • Office Health and Safety Officer (OHSO): | Russell J. Chadwick |
| • Site Health and Safety Officer (SHSO): | William S. Elwell |
| • Alternate: | Darren W. Lamsma |
| • Project Manager: | Ron St. John |

The following individuals located onsite will have the authority and responsibility to change levels of protection and, when necessary, shut down the operation:

- Site Health and Safety Officer
- Alternate Site Health and Safety Officer

PERSONNEL ROLES

Office Health and Safety Officer:

The Office Health and Safety Officer (OHSO) has overall responsibility for establishing appropriate health and safety procedures. The OHSO is responsible for documenting that employees have received proper health and safety training and have participated in a medical surveillance program.

Site Health and Safety Officer:

The Site Health and Safety Officer (SHSO) is responsible for documenting that the designated procedures and health and safety protocol are implemented in the field. The SHSO may be required to perform various types of area or personnel monitoring for purposes of verifying worker exposure and proper selection of personal protective equipment. The SHSO should be consulted before any changes in the recommended procedures or levels of protective clothing are made.

Project Manager:

The Project Manager (PM) has the primary responsibility for the fulfillment of the terms of the contract. He must oversee operations and ensure that all legal and safety requirements are met. It is his duty to keep the project on schedule and within budget, and to communicate with the client regarding the progress toward the specified project goals.

1.3.2 OSHA-Required Training and Medical Surveillance

Clayton employees and subcontractors who will be on the site will have received a minimum of 40 hours of hazardous waste site investigation health and safety training, and annual 8-hour Refresher Courses, as required in 29 CFR 1910.120, and be a participant in a medical surveillance program.

1.3.3 First Aid

The Clayton SHSO will be immediately advised of any situation requiring more than minor first aid. A first aid kit that meets the requirements of 29 CFR 1926.50 is maintained in each of the Clayton vehicles, and supplies will be replenished by the SHSO as needed. Personnel aware of accidents or injuries will take immediate action to ensure

that appropriate first aid is administered and report the incident to the SHSO. The majority, if not all, of the Clayton personnel are certified and trained in first aid/CPR.

1.4 GENERAL GUIDELINES

The following personal hygiene and work conduct guidelines are intended to prevent injuries and adverse health effects. These practices establish general precautionary measures for reducing the risks associated with potentially hazardous work at site operations.

- Eating, drinking, chewing gum or tobacco, taking medications, and smoking are prohibited onsite during field activities.
- Avoid direct contact with potentially contaminated substances; to the extent possible do not walk through puddles, pools, drill cuttings, or mud; avoid kneeling, leaning, or sitting on the drums or working equipment. Do not place monitoring or sampling equipment on potentially contaminated surfaces.
- Be alert to potentially changing exposure conditions, including changes in wind direction, perceptible odors, unusual appearances of soil or groundwater, etc.
- Be alert to fatigue, heat or cold stress, and other environmental factors influencing the normal caution and efficiency of personnel.
- Onsite personnel will establish prearranged hand signals or other means of emergency communication when wearing respiratory equipment (equipment seriously impairs speech communications).
- Always use an appropriate level of personal protective gear. Lesser levels can result in unnecessary exposure; excessive levels of safety equipment can impair efficiency and increase the potential for accidents to occur.

1.5 SITE SAFETY MEETING

Site safety orientation/training meetings (briefings) will be convened (1) before the field team begins work at the site; (2) when there are modifications to the HASP that are

applicable to the field personnel; and (3) when additional personnel or subcontractors begin work. Meetings will be attended by personnel involved in carrying out the project and will be presided over by the SHSO or his/her designee.

The meeting agenda will include the following minimum activities:

- Review the HASP with the attendees.
- Distribute any HASP modifications.
- Collect the attendees' signatures acknowledging receipt and understanding of the site and HASP and their agreement to comply with the plan (Tailgate Meeting Minutes Form, Attachment A).

2.0 HAZARD EVALUATION

Available data for the site indicate that potential chemical hazards may be present in various environmental media onsite. The following summarizes the potential chemical and physical hazards associated with each of the planned field activities:

Field Activity	Potential Hazard
Soil Boring and Soil Sampling	Direct contact with contaminants in soil; heat/cold stress; heavy machinery noise; trips, slips, and falls; inhalation or ignition of escaping vapors or gases; inhalation of windblown dust; contact of drill rig with underground lines and of drill rig mast with overhead electrical lines.
Drilling, Installing, and Developing Monitoring Wells	Direct contact with contaminants in soil, groundwater; heat/cold stress; heavy machinery noise; trips, slips, and falls; inhalation or ignition of escaping vapors or gases; inhalation of windblown dust; contact of drill rig with underground lines and of drill rig mast with overhead electrical lines.
Water Level Determination, Slug Testing, and Groundwater Sampling	Direct contact with contaminants in groundwater; heat/cold stress; trips, slips, and falls; inhalation or ignition of escaping vapors or gases in wells.
Surveying	Trips, slips, and falls; inhalation of windblown dust.
SRH/SVE System	Direct contact with dangerous voltages, high ground temperatures, and steam under positive pressure; trips, slips, and falls; inhalation or ignition of escaping vapors or gases from the system

2.1 SIGNS AND SYMPTOMS OF ACUTE EXPOSURE

The majority of tasks slated for this project, at this time, involve sampling soil and, potentially, groundwater. These tasks could involve possible exposure to substances that may be hazardous to the health of site personnel. The risk of exposure via inhalation and skin contact is likely greater than ingestion. None of the suspected contaminants onsite are expected to volatilize in quantities great enough to permit dermal absorption of the gas.

The signs and symptoms that may occur (function of concentration) as a result of exposure to some potentially hazardous constituents at the site are listed below:

- *Trichloroethene*: Symptoms of exposure include irritation of eyes and skin, headache, vertigo, visual disturbance, fatigue, giddiness, tremors, somnolence, nausea, vomiting, dermatitis, cardiac arrhythmias, paresthesia, and liver injury. The target organs include the eyes, skin, respiratory system, heart, liver, and central nervous system.
- *Tetrachloroethene*: Symptoms of exposure include irritation of eyes, nose, and throat, nausea, flush face and neck, vertigo, dizziness, incoordination, headaches, somnolence, skin erythema, and liver damage. The target organs include the eyes, skin, respiratory system, liver, kidneys, and central nervous system.
- *1,2-Dichloroethene*: Symptoms of exposure include irritation of eyes and respiratory system, and central nervous system depression. The target organs include eyes, respiratory system, and central nervous system.
- *Vinyl Chloride*: Symptoms of exposure include weakness, abdominal pain, gastrointestinal bleeding, enlarged liver, pallor or cyanosis of extremities, liquid, and frostbite. The target organs are the liver, central nervous system, blood, respiratory system, and lymphatic system.
- *1,1,1-Trichloroethane*: Symptoms of exposure include irritation of eyes and skin, headache, lassitude, central nervous system depression, poor equilibrium, dermatitis, cardiac arrhythmias, and liver damage. The target organs are the eyes, skin, central nervous system, cardiovascular system, and the liver.
- *1,1,2-Trichloroethane*: Symptoms of exposure include irritation of eyes and nose, central nervous system depression, liver and kidney damage, and dermatitis. The

target organs are the eyes, respiratory system, central nervous system, liver and kidneys.

The above information is from the *NIOSH Pocket Guide to Chemical Hazards*, U.S. Department of Health and Human Services, June 1997.

2.2 COLD STRESS

When temperatures are expected to be in the 40s or lower, especially during high winds, cold stress will be considered. Cold stress presents several different syndromes: mild hypothermia and profound hypothermia, frostbite, and chilblains.

The signs and symptoms of hypothermia include shivering, poor coordination, slowed pace, irritability, slurred speech, fatigue, and poor judgement. More severe hypothermia can result in stupor, collapse, and eventually death.

The signs and symptoms of frostbite include stiffness and numbness in body parts (i.e., nose, ears, toes, fingers, etc.), and a noticeable grayish or whitish skin color.

Workers will be encouraged to wear layers of protective, insulated clothing; keep hands, head, and feet covered and warm; keep clothes dry; eat high energy foods; and drink plenty of water.

Warm shelter will be provided out of the wind for rest periods. Crews will be encouraged to get warm and dry during lunch periods. Warm liquids with caloric value will be provided, and ample water is essential. Dehydration is a factor in hypothermia and frostbite, and will be avoided.

Table 1 describes the recommended breaks for a four-hour work period during periods of cold weather.

The medical emergency response procedures for victims who may have developed cold stress are outlined in Section 5.0.

2.3 HEAT STRESS

When activities may require the use of coveralls and/or respirators, certain precautions will be required to reduce the likelihood of heat fatigue, heat exhaustion, and heat stroke. Heat stroke, in particular, is a life-threatening condition. All employees will be alert to the symptoms of heat exhaustion, which include extreme fatigue, cramps, dizziness, headache, nausea, profuse sweating, and pale clammy skin.

Heat stroke or the stage immediately preceding it includes bright red skin, or a bluish face or conjunctiva, tremors leading to convulsions, delirium, struggling, bright red chest area, hot skin, headache, and vertigo. Collapse, unconsciousness, coma, and death may follow.

Workers will be encouraged to drink liquids from the time they wake up and frequently during the workday. Table 2 describes the recommended minimum breaks for work performed in protective clothing during hot weather.

The medical emergency response procedures for a victim who may have developed heat stress are described in Section 5.0.

2.4 HEAVY MACHINERY

Heavy machinery will be onsite during drilling activities, and particular care will be maintained to avoid accidents. The hazard is increased if personal protective gear that

reduces mobility is required. Many opportunities for accidents exist while working near drilling rigs. In general, workers will be aware of the danger of:

- Falling or swinging objects suspended from winches or cables.
- Drilling hardware breaking and flying free, especially while the rig is operating near its limit.
- Contacting overhead electrical lines with the drill rig mast.
- Exploding hoses.
- Entangling personal protective equipment with moving machinery (i.e., spinning augers, etc.).
- Slips, trips, and falls on drilling equipment (e.g., augers, etc.).

Each drilling rig and drilling method presents different specific hazards. Drilling rig and drilling method specific hazards will be discussed in the site safety meeting prior to initiating work and/or if a new method or drilling rig will be used at the site.

The onsite drilling supervisor is responsible for ensuring that the drill rig and the drilling site are ready for safe work conditions. He/she is responsible for ensuring that safe working procedures are followed.

The area utility locator will be contacted prior to drilling to determine the location of all suspected utility lines onsite. The use of a drill rig in the vicinity of electrical power lines, either overhead or buried, requires that special precautionary measures be taken by all involved in site work operations.

2.5 NOISE

Excessive noise is typically encountered while working with heavy machinery such as drilling rigs. The effects of working in the vicinity of noise include:

- Workers being startled, annoyed, or distracted.
- Physical damage to the ear, pain, and temporary and/or permanent hearing loss.
- Communication interference that may increase potential hazards due to the inability to warn of danger and the proper safety precautions to be taken.

Hearing protection will be required for drillers/personnel positioned near drill rigs or when in the immediate vicinity of these types of heavy equipment. Hearing protection will be available onsite (Section 4.4). The effect of occupational exposure to noise is monitored by Clayton or the subcontractor medical surveillance program. Since voice communication may be affected during excessive noise, hand signals may be used in conjunction with voice communication. Hand signals are discussed in Section 4.1.

2.6 SRH/SVE SYSTEM

2.6.1 Electrical Voltages

Dangerous voltages can be present in the SRH field during heating operation. Therefore, this region is a personnel exclusion zone when voltage is applied to the electrodes. A chain-link security fence will surround the personnel exclusion zone to inhibit entrance by unauthorized personnel. This fence will be located such that step-touch potential on the fence does not exceed 15 volts.

During start-up, the voltage applied to the electrodes will be slowly increased. During this voltage ramp-up, the step-touch voltage outside the exclusion zone is repeatedly

measured. Special attention is directed toward metal objects located within 100 feet of the array. Additionally, step-touch potentials will be measured at multiple locations within the adjacent shop.

If start up measurements indicate that potentially hazardous voltages might develop outside of the treatment zone, then the voltage will be corrected by one or more options including, but not limited to:

- Improving the grounding system by re-orientating the surface grid, by connecting the offending component to the facility ground system, or by adding grounding rods.
- Breaking the conductive path that directs voltage out of the exclusion zone.
- Modifying the boundaries of the exclusion zone.

2.6.2 High Temperatures

During operation of the SRH system at the boiling point of water, the electrodes and metal wells in the field may approach this temperature. Following shutdown, it may take several days for the steel casing to cool below a safe handling temperature of 60 degrees C (140 degrees F). Severe burns may result from contact with these components without the use of proper protective equipment. Gloves will be required to handle the well attachments during this period. Care should be taken with regard to these temperatures during any sampling that occurs during active heating and for several weeks following shutdown of the system.

2.6.3 Steam

Steam will be generated in the subsurface during operation of the SRH/SVE system. This steam will be present throughout the treatment area. In addition, steam will be present in the SVE piping running from the wells in the vicinity of the treatment area and the condenser. In some instances, this steam may be developed under a positive pressure. Care must be taken to avoid exposing personnel to any source of steam. Face shields and gloves should be worn when entering any piping or component that may contain steam.

2.6.4 Access Control

Due to the hazards described above, a SRH/SVE remediation site has strict access control requirements. The personnel exclusion zone will be established just prior to the first application of power to the electrodes. **Once the personnel exclusion zone is established, no one may enter the exclusion zone until they have been trained by Thermal Remediation Services (TRS), and they have reviewed the work plan and signed the acknowledgement sheet (Attachment C).** Prior to entering the exclusion zone, trained personnel must lock out and tag out the SRH power supply as described below.

The Lockformer facility will have a chain-link fence that surrounds the personnel exclusion zone. A second chain-link fence will surround the remediation equipment (equipment zone). Personnel who have not received TRS training may enter the equipment zone if accompanied by someone who has received training in accordance with OSHA 29 CFR 1910.120, but will not be allowed in the exclusion zone. (Personal protection requirements are outlined in Table 3.)

2.7 LOCK OUT / TAG OUT PROCEDURES

Only personnel experienced or trained to operate or perform maintenance on the remediation equipment or individual components are authorized to conduct the lock out/tag out procedures summarized below. The following procedures must be followed when the remediation system is being serviced.

2.7.1 Lock Out / Tag Out:

1. Prior to commencing lock out/tag out procedures, the SHSO must be notified.
2. Prior to servicing equipment, turn off the disconnect switch on the electrical enclosure or the disconnect switch for the equipment depending on which piece of equipment is being serviced.
3. Unlock the cover to the circuit box and turn off the disconnect switches to the specific equipment being repaired or maintained.
4. Lock the cover to the circuit box. Only the person who unlocked the circuit box cover should retain the key.
5. Attach a weatherproof label to the lock indicating the following information: name and signature of the individual who shut off the disconnect switches and performed the maintenance on the equipment; time and date of lock out; and explanation of the work performed on the remediation equipment. Also, note the repair or maintenance being performed in the project log book.

2.7.2 Release From Lock Out / Tag Out:

1. The SHSO must be notified before removing the lock out/tag out devices.
2. Inspect the area to verify that the equipment has been returned to operational condition. All tools and equipment used to service the equipment should be accounted for and placed in a safe location.

3. All personnel must move to positions away from any mechanical and/or pneumatic equipment prior to the removal of the lock out/tag out devices.
4. The lock out/tag out devices must be removed by the person who signed the lock out/tag out label.
5. The disconnect switches for the equipment should be turned on.
6. Lock the circuit box cover.
7. Turn on the disconnect switch(es) for the equipment and re-start the systems in accordance with the operation manual.

2.8 EARTH MOVING / EXCAVATION

The current remedial design does not involve earthmoving/excavation activities, but in the instance that it may have to be utilized particular care will be maintained to avoid accidents and the contractor will comply with the requirements specified in 29 CFR 1926, Subpart "O" and "P".

The area utility locator will be contacted to determine the location of all suspected utility lines onsite. Earthwork/excavation in the vicinity of electrical power lines, either overhead or buried, requires special precautionary measures by all involved in site work operations.

The SHSO and earthmoving/excavation subcontractor's foreman are responsible for ensuring that the necessary equipment and work site are ready for safe working conditions. They are also responsible for ensuring that safe working procedures summarized below are followed:

- All earthmoving/excavation equipment will be operated by qualified personnel following general safe operating procedures in terms of equipment tolerance, clearance, capacities, etc.
- Equipment shall be maintained properly, and periodically inspected to ensure safe operation.
- No unauthorized persons will be allowed within the limits of operations while any earthmoving/excavation equipment activities are going on.
- Any open excavation area left unattended during the day or overnight will be properly secured with caution tape from casual access.

3.0 SITE MONITORING AND ACTION LEVELS

Air monitoring will be performed in order to ensure that appropriate engineering controls and personal protective equipment are adequate for the tasks being performed. During activities in which atmospheric monitoring is required, a photoionization detector (PID) with a 10.2 electron-volt (eV) lamp will be used. Most potentially hazardous volatile organic compounds are readily detectable with a PID instrument. The PID will be calibrated at the beginning of each day.

3.1 MONITORING FREQUENCY

The following chart summarizes the initial frequency of air monitoring with the PID for each of the principal field activities.

Field Activities	Initial Location and Frequency of Monitoring
Soil boring and soil sampling	Check borehole and breathing zone periodically during drilling/augering for escaping vapors. Monitor during the handling of the sample.
Drilling, installing, and developing groundwater monitoring wells	Check borehole and breathing zone periodically during drilling for escaping vapors.
Water level determination, slug testing and groundwater sampling	Check well and breathing zone initially after opening well.

Air monitoring may be decreased or increased in frequency depending on the conditions identified during field activities.

3.2 ACTION LEVELS

Unless otherwise stated, the following PID action levels are for the breathing zone.

PID Reading (in ppm)	Personal Protection Level
Non-intrusive activity	Level D
Background < PID < 5	Level D
5 < PID < 50	Level C organic vapor cartridges
50 ≤ PID	Evacuate work area, allow to vent for 10 minutes, and then monitor again. If still above action level, evacuate area and contact SHSO.

NOTES:

The action levels were obtained from the *NIOSH Pocket Guide to Chemical Hazards*, U.S. Department of Health and Human Services, June 1997.

ppm = parts per million

Readings taken in the breathing zone will be documented in a field logbook. Respirators will be donned if Level C action levels are exceeded, and they may be removed once Level C action levels are no longer exceeded. If the action levels for evacuation of the work area are exceeded, work will be suspended in the immediate vicinity of the borehole for 10 minutes in order to allow the excavation to vent. After the 10-minute venting period, air in the breathing zone will be monitored by a Clayton field supervisor wearing a respirator and approaching the hole from the upwind direction. If the PID indicates that organic vapor concentrations are less than the action levels, work will continue; otherwise, the hole will be allowed to continue to vent for 10 additional minutes and the process will be repeated. If air monitoring results in the breathing zone continue to exceed action limits, the work area will be evacuated.

4.0 ONSITE CONTROL

4.1 SITE COMMUNICATION

When voice communication is not possible, field investigators may utilize the following signals:

- Waving hand toward the body in a "come here" gesture - COME HERE.
- Pushing one or both hands away from the body in a "back up" gesture - BACK UP.
- Extending both arms, hands open, palms forward, and stopping them abruptly, directly in front of the torso at shoulder level - STOP RIGHT WHERE YOU ARE.
- Throwing the right clenched fist with extended right thumb abruptly over the right shoulder in a "let's get out of here" gesture - LET'S GET OUT OF HERE!
- Thumbs up - YES/EVERYTHING'S OKAY.
- Thumbs down - NO/THIS DOESN'T LOOK GOOD.
- Hands grasping throat - I'M CHOKING/OUT OF AIR.
- Hands on top of head - I NEED ASSISTANCE.

4.2 SAFETY ZONES AND ACCESS CONTROL

Control boundaries for site work will be established and will consist of the Exclusion Zone, the Decontamination Zone, and the Clean Zone. The following is a description of each control zone:

- The Exclusion Zone will be the area within 10 feet around an onsite monitoring well, borehole, or sampling point.

- The Decontamination Zone (contamination reduction where decontamination takes place) will be the area from the perimeter of the Exclusion Zone to a 15- to 20-foot radius.
- The Clean Zone (support area where workers should not be exposed to hazardous conditions) will be the area beyond the Decontamination Zone.

Movement of equipment and personnel among these zones should be minimized to prevent cross-contamination from contaminated areas to clean zones.

Site personnel will be briefed by the SHSO as to the location of work areas and Exclusion Zones, decontamination area, telephone(s), eye wash, fire extinguisher(s), prevailing wind direction, utility lines (if not marked onsite), and first aid kit(s).

Potable water for health and safety procedures and decontamination procedures will be brought to the site as needed by site personnel and will be available in the Decontamination Zone and in the Clean Zone.

4.3 PERSONAL PROTECTIVE EQUIPMENT

All site investigatory activities will begin and will likely be completed using Level D personal protection equipment (PPE). The PPE will be upgraded to Level C if breathing zone atmosphere exceeds Level C action levels. In instances of continued windblown dust, Level C 1 HEPA filters shall be used. The specific PPE required for Level C and D is outlined in Table 2. Hearing protection will be available and is recommended to be used during drilling operations.

Where air purifying respirators are deemed necessary, organic vapor cartridges appropriate for use with the substances and concentrations anticipated will be worn (Level C). The make of the respirator and cartridge varies for each person depending on the results of individual fit-tests. Cartridges will be replaced at the start of each work day

and if or when breakthrough occurs. Changes to the levels of protection will not be made without the knowledge and approval of the SHSO.

A respiratory protection plan is in effect at Clayton. Clayton field personnel have been properly trained in care and maintenance of respirators. Clayton field personnel have been properly fitted and fit-tested according to OSHA regulations. Clayton personnel have been medically evaluated and cleared for respiratory protection use by a licensed physician.

4.4 ADDITIONAL EMERGENCY AND SAFETY EQUIPMENT

Whenever work is conducted, the following equipment will be available at the job site (e.g., Clayton field vehicle, or at a designated location in the Clean Zone):

- Ear plugs, disposable
- An ABC fire extinguisher (inspected annually)
- First aid kit that meets the requirements of 1926.50
- Traffic cones, and/or caution tape

In addition, Material Safety Data Sheets (MSDS) or Chemical Hazards Response Information System (CHRIS) Sheets will be available at the site for substances that pose a reasonable health and safety risk to site personnel as listed in Section 2.1. MSDS and CHRIS Sheets are included as Attachment B.

4.5 DECONTAMINATION

All work will be performed in Level D personal protection, and no personal decontamination area will be set up. Should conditions change at the site causing an upgraded level of protection, an area will be specified and all workers informed of the necessary procedures.

All nondisposable sampling equipment that comes into contact with site soils, sediments, and surface water will either be steam cleaned or washed with a detergent solution and rinsed with distilled water.

While in Level D, all disposable protective clothing will be disposed of as general refuse. Decontamination of equipment will take place on designated areas onsite. If an upgrade to Level C occurs, all nondisposable protective equipment will be cleaned in a specified contaminant reduction zone prior to leaving the site. The protective equipment will be cleaned with a detergent wash and rinsed with distilled water. Rinsate water will be managed and remain onsite.

5.0 CONTINGENCY AND EMERGENCY PROCEDURES

The nearest telephone will be a Clayton mobile phone. Subcontractors may also have a mobile phone.

The following contingency plans have been developed to deal with major incidents that might occur during field activities. Clayton employees and subcontractors will familiarize themselves with the location of the nearest permanent phone and the designated medical facility. The location of Advocate Good Samaritan Hospital is shown on Figure 2, together with the shortest route from the site to the hospital. The route is as follows:

1. Go east on Ogden Avenue to Main Street.
2. Take Main Street (becomes Highland Ave.) north to Advocate Good Samaritan Hospital.

A copy of the "List of Emergency Telephone Numbers" (Section 5.6) will be carried along with Clayton's and the subcontractors' (if available) mobile phones. Contingency response plans will be reviewed with onsite personnel weekly to promote timely implementation of the contingency plan should one of the events described in the following section occur.

5.1 MEDICAL EMERGENCY RESPONSE PLAN

Should any person visiting or working at the site be injured or become ill, notify the SHSO and initiate the following emergency response plan:

Note: *The anticipated nature of chemical contamination on this project does not present an immediate threat to human health. Other than removal of outer garments and*

gross contamination, immediate emergency treatment of injuries will take precedence over rigorous personal decontamination.

1. If able, the injured person will proceed to the nearest available source of first aid. If necessary, wash the injured area with soap and water.
2. If the injury involves foreign material in the eyes, immediately flush the eyes with emergency eye wash solution, and rinse with copious amounts of water at the nearest emergency eye wash station. Obtain or administer first aid as required. If further medical treatment is required, seek medical assistance as discussed below.
3. If the victim is unable to walk, but is conscious, and there is no evidence of spinal injury, escort or transport the injured person to the nearest first aid facility. If the victim cannot be moved without causing further injury, such as in the case of a severe compound fracture, take necessary emergency steps to control bleeding and immediately call for medical assistance as discussed below.
 - If the victim is unconscious or unable to move, **Do Not Move the Injured Person Unless Absolutely Necessary to Save His or Her Life**, until the nature of the injury has been determined.
 - If there is any evidence of spinal injury, do not move the victim. Administer CPR if the victim is not breathing, control severe bleeding, and immediately contact the Advocate Good Samaritan Hospital Emergency Room at 630.275.5900 and advise them of the situation. Otherwise, seek medical assistance as discussed below.
4. If the injury to the worker is related to the physical hazards previously identified in Section 2.0, appropriate first-aid procedures will be instituted as follows:
 - **Hypothermia** - If a worker suffers from hypothermia, medical attention will be sought immediately. The employee will be moved out of the cold, and warm clothing or blankets will be provided. Warming will take place slowly; no food or beverage will be administered.
 - **Frostbite** - Any worker suffering from frostbite will be moved to a warm area immediately. Frostbitten areas of the body will be placed in warm (100 to 105 degrees) water, NOT hot water. Areas of concern will be handled gently and will not be rubbed or massaged. If toes or fingers are affected, gauze will be placed between them after warming them. The injured parts will be loosely bandaged. If the part has been thawed and refrozen, it will be re-warmed at room temperature. If necessary, medical assistance will be sought.

- *Heat Stroke* - If a worker suffers a heat stroke, medical attention will be sought immediately. The victim will be moved out of the heat and into a cooler area. The victim will be cooled as quickly as possible by immersing him or her in a cool bath, or wrapping wet sheets around the body. While waiting for an ambulance to arrive, the victim will be watched for symptoms of shock. Nothing will be given orally.
 - *Heat Exhaustion* - If any worker suffers from heat exhaustion, he or she will be moved out of the heat and into a cooler place. The victim will lie down with his or her feet up. Clothing will be removed or loosened; cold packs, wet towels, or sheets will be used to cool the skin. One-half glass of water will be administered every 15 minutes if the victim is fully conscious and can tolerate it. During all of these procedures, the victim will be observed for symptoms of shock. If the victim has not recovered within a half hour, or if the victim's condition worsens, medical attention will be sought.
5. If further medical treatment is required and
 - (a) The injury is not severe, contact Advocate Good Samaritan Hospital and take the injured party to the hospital by private automobile.
 - (b) The injury is severe, immediately call EMS (911). In the interim, call the Advocate Good Samaritan Hospital Emergency Room (630.275.5900) and advise them of the situation.
 6. The SHSO will accompany the injured person to the hospital to ensure prompt and proper medical attention. After proper medical treatment has been obtained, the SHSO will notify the OHSO and prepare a written report.

5.2 FIRE AND EXPLOSIONS

In the event of a fire or explosion the SHSO will take the following steps:

1. If the situation is readily controllable, take immediate action to do so.
2. If the situation is uncontrollable, clear personnel working in the immediate area and notify the local Fire Department (911).
3. Notify the OHSO.

Clayton personnel will remain at the scene of the fire until the local fire department arrives. Once professional fire fighting personnel have arrived, Clayton personnel will remain at the disposal of the fire chief. The SHSO will function as liaison between response personnel in the incident.

5.3 CHEMICAL EXPOSURE FIRST AID

The following procedures will be followed in case of chemical exposure during field activities:

- *Eye contact:* Flush with clean water for 15 minutes or more. Try to flush under the lids. Get medical attention immediately.
- *Inhalation:* Get person to fresh air. Monitor for signs of exposure. Watch for signs of respiratory difficulty. Call EMS. Perform emergency rescue breathing, if appropriate, until relieved by an emergency unit.
- *Skin contact:* Flush area with clean water for at least 15 minutes. If burns are evident, get immediate medical attention. Do not use soap on affected area. BEWARE: Signs and symptoms may develop later due to dermal exposure.
- *Ingestion:* If contaminated materials are ingested, vomiting will not be induced. Medical attention will be sought immediately.

If anyone has been overexposed or has shown or is showing signs of exposure, he/she will be examined by a physician, according to OSHA's 1910.120 (f).

5.4 UNFORESEEN CIRCUMSTANCES

The Health and Safety procedures specified in this plan are based on available data that suggest minimal potential for worker exposure to significant levels of hazardous substances. If substantially higher levels of contamination are encountered in the soil or groundwater, and/or if situations arise that are obviously beyond the scope of the monitoring, respiratory protection, and decontamination procedures specified, work activities will be modified or, if necessary, halted pending discussion with the OHSO and implementation of appropriate protective measures.

5.5 LIST OF EMERGENCY TELEPHONE NUMBERS

Medical Services (EMS)	911
Police/ Fire Department	911 -- Emergency
Advocate Good Samaritan Hospital 3815 Highland Avenue Downers Grove, Illinois	630.275.5900
Poison Control Center	800.942.5969
National Response Center	800.424.8802
Clayton Group Services, Inc. Mr. Ron St. John or Mr. Russell J. Chadwick	630.795.3200
Lockformer Mr. Rian Scheel	630.964.8000
Thermal Remediation Services (TRS) Mr. David L. Fleming	425.603.9036

6.0 CONFINED SPACE ENTRY

Site personnel will not be entering any confined spaces during field activities; therefore, confined space entry procedures are not required.

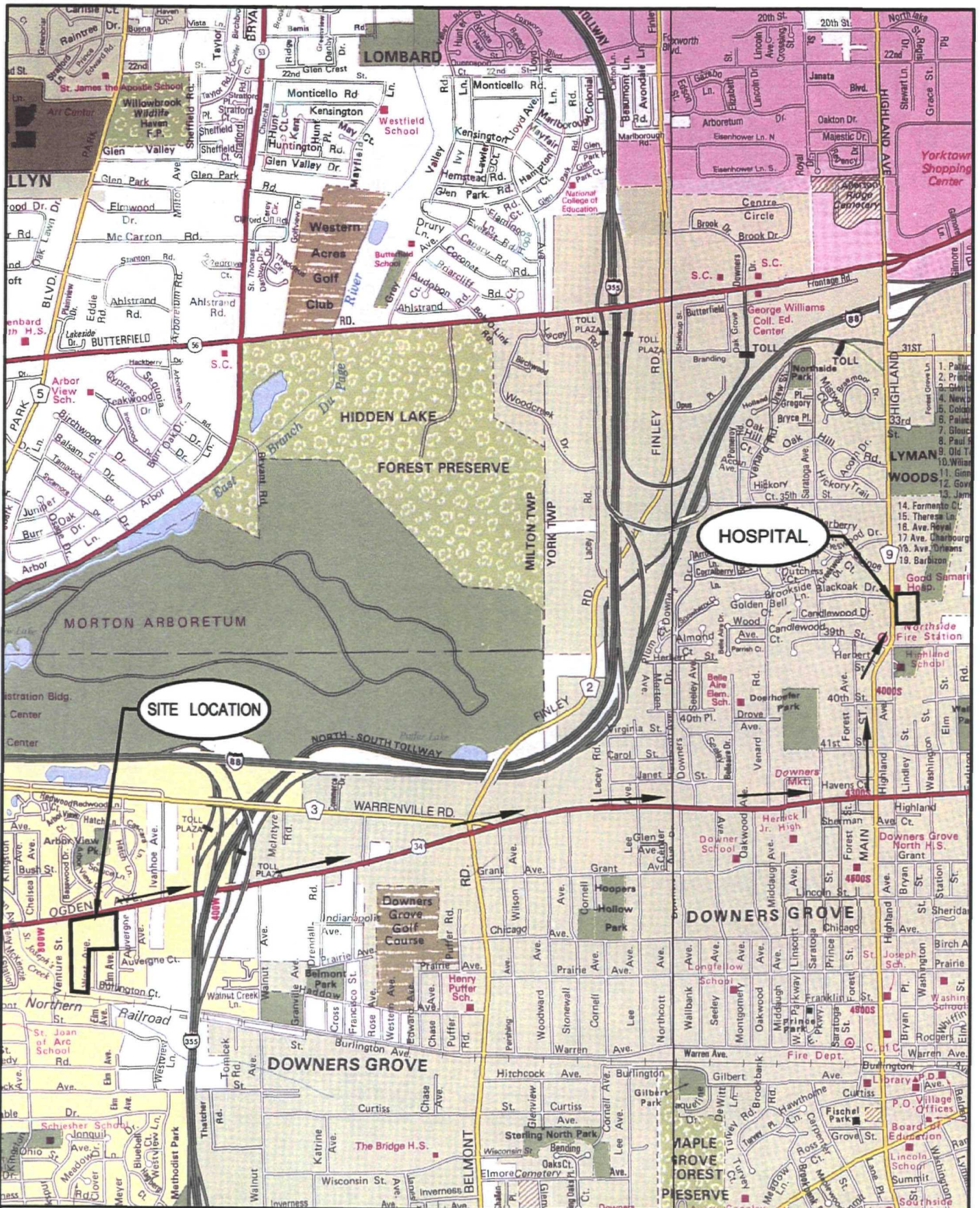
7.0 SPILL CONTAINMENT PROGRAM

Spills requiring a written spill containment program are not anticipated for the proposed activities. Groundwater generated during development or purging of monitoring wells will be collected and staged in a secure area onsite in 55-gallon drums. All drums will be labeled as to their contents and date of origin. Upon receipt of analytical data, the water will be characterized, if necessary. The drummed waters will then be appropriately managed offsite. In the event the water does not require offsite disposal, it will be spread on the site.

8.0 REFERENCES

- American Conference of Governmental Industrial Hygienists (ACGIH). *1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, 1991.
- Clayton Environmental Consultants. *Corporate Safety and Health Plan*, 1997.
- 40 CFR 300 National Contingency Plan.
- National Institute for Occupational Safety and Health (NIOSH) / OSHA / United States Coast Guard (USCG) / Environmental Protection Agency (EPA). *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, October 1985.
- Occupational Safety and Health Administration (OSHA). Construction Industry Standards 29 CFR 1926.
- OSHA General Industry Standards 29 CFR 1910.120. *Hazardous Waste Operations and Emergency Response*.
- U.S. Department of Health and Human Services. *NIOSH Occupational Health Guidelines for Chemical Hazards*, January 1991.
- U.S. Department of Health and Human Services. *NIOSH Pocket Guide to Chemical Hazards*, June 1997.
- ISOPIA Guidance Document. *Standard Operating Safety Guides*, June 1992.
- ISOPIA software. *Superfund Health and Safety Planner*, 1993.

FIGURES



CHECK BY	
DRAWN BY	BCP
DATE	12-5-01
SCALE	AS SHOWN
CAD NO.	6526308A
PRJ NO.	65263.01

ROUTE TO HOSPITAL

THE LOCKFORMER COMPANY
711 OGDEN AVENUE
LISLE, ILLINOIS



FIGURE

TABLES

TABLE 1

**RECOMMENDED WORK BREAKS DURING COLD WEATHER
FOR A FOUR-HOUR WORK PERIOD**

<u>AIR TEMPERATURE SUNNY SKY (F)</u>	<u>NO WIND</u>		<u>5 MPH WIND</u>		<u>10 MPH WIND</u>		<u>15 MPH WIND</u>		<u>20 MPH WIND</u>	
	<u>Work Period</u>	<u>Breaks</u>	<u>Work Period</u>	<u>Breaks</u>	<u>Work Period</u>	<u>Breaks</u>	<u>Work Period</u>	<u>Breaks</u>	<u>Work Period</u>	<u>Breaks</u>
<u>-15 to -19</u>	<u>Normal</u>	<u>Normal</u>	<u>Normal</u>	<u>Normal</u>	<u>75 min.</u>	<u>2</u>	<u>55 min.</u>	<u>3</u>	<u>40 min.</u>	<u>4</u>
<u>-20 to -24</u>	<u>Normal</u>	<u>Normal</u>	<u>75 min.</u>	<u>2</u>	<u>55 min.</u>	<u>3</u>	<u>40 min.</u>	<u>4</u>	<u>30 min.</u>	<u>5</u>
<u>-25 to -29</u>	<u>75 min.</u>	<u>2</u>	<u>55 min.</u>	<u>3</u>	<u>40 min.</u>	<u>4</u>	<u>30 min.</u>	<u>5</u>	<u>Stop Work</u>	<u>Stop Work</u>
<u>-30 to -34</u>	<u>55 min.</u>	<u>3</u>	<u>40 min.</u>	<u>4</u>	<u>30 min.</u>	<u>5</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>
<u>-35 to -39</u>	<u>40 min.</u>	<u>4</u>	<u>30 min.</u>	<u>5</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>
<u>-40 to -44</u>	<u>30 min.</u>	<u>5</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>
<u>-45 and</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>	<u>Stop Work</u>

Source: 1991-1992 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, ACGIH, 1991.

TABLE 2

RECOMMENDED WORK BREAKS DURING HOT WEATHER

<u>TEMPERATURE</u>	<u>WORK</u>	<u>REST</u>	<u>COMMENTS</u>
<u>70 to 75 F</u>	<u>3.0 hours</u>	<u>5 minutes</u>	<u>Review heat stress in a safety meeting. Schedule a beverage break every 2 hours at a minimum.</u>
<u>75 to 80 F</u>	<u>3.0 hours</u>	<u>15 minutes</u>	<u>Seated rest. Drink at least 8 ounces at each break. Monitor daily body weight changes. Have at least 10 instant ice packs or bags of ice available.</u>
<u>80 to 85 F</u>	<u>2.0 hours</u>	<u>10 minutes</u>	<u>As above, but rest area to be shaded. Take pulse before work, at beginning of lunch break, and at end of day.</u>
<u>85 to 90 F</u>	<u>1.5 hours</u>	<u>10 minutes</u>	<u>As above, and try to provide a shaded work area. More frequent breaks may be required.</u>
<u>90 and</u>	<u>1.5 hours</u>	<u>10 minutes</u>	<u>As above. Try to reschedule work to avoid mid-day heat.</u>

TABLE 3

Levels Of Personal Protective Equipment

LEVEL D	Hard hat Safety glasses or goggles Steel toe boots Latex gloves (task dependent) Work gloves (task dependent) Neoprene gloves (task dependent) Hearing protection Coveralls
LEVEL C	Hard hat Safety glasses or goggles Steel toe boots/impermeable Latex inner gloves Neoprene outer gloves Hearing protection Coveralls Air purifying respirator Cartridges (organic vapor/acid gas)

ATTACHMENT A

TAILGATE MEETING MINUTES FORM

TAILGATE MEETING MINUTES

Project No.: _____ Client: _____

Location: _____ Month: _____

of Employees: _____

Safety Topic #: _____ Title: _____

Other items discussed/listed:

Employee Safety Suggestions:

Supervisor's signature / Print Name Date

EMPLOYEE NAMES:

Print Name

Signature

COMPLETED FORM TO BE RETURNED TO H&S COORDINATOR

ATTACHMENT B

MSDS AND CHRIS SHEETS

TRICHLOROETHYLENE

TCL

CAUTIONARY RESPONSE INFORMATION

Common Synonyms	Watery liquid	Colorless	Sweet odor
Chloroethene Gamaethene Tributylene Trichloroethene Trichloroethylene Trilene	Sinks in water. Irritating vapor is produced.		
Keep people away. Avoid contact with liquid and vapor. Call fire department. Notify local health and pollution control agencies. Protect water intakes.			
Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.		
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.		
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.		

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Contain
Collection Systems: Pump

2. CHEMICAL DESIGNATIONS

- 2.1 CG Compatibility Group: 38; Halogenated hydrocarbon
- 2.2 Formula: CH2ClCHCl2
- 2.3 IMO/UN Designation: 9.0/1710
- 2.4 DOT ID No.: 1710
- 2.5 CAS Registry No.: 79-01-8
- 2.6 NAERG Guide No.: 160
- 2.7 Standard Industrial Trade Classification: 51132

3. HEALTH HAZARDS

- 3.1 Personal Protective Equipment: Organic vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or vinyl gloves; chemical safety goggles; face shield; neoprene safety shoes; neoprene suit or apron for splash protection.
- 3.2 Symptoms Following Exposure: INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.
- 3.3 Treatment of Exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.
- 3.4 TLV-TWA: 50 ppm
- 3.5 TLV-STEL: Not listed.
- 3.6 TLV-Ceiling: 100 ppm
- 3.7 Toxicity by Ingestion: Grade 3; LD₅₀ = 50 to 500 mg/kg
- 3.8 Toxicity by Inhalation: Currently not available.
- 3.9 Chronic Toxicity: Currently not available
- 3.10 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
- 3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
- 3.12 Odor Threshold: 50 ppm
- 3.13 IDLH Value: 1,000 ppm
- 3.14 OSHA PEL-TWA: 100 ppm
- 3.15 OSHA PEL-STEL: 300 ppm, 5 minute peak in any 2 hours.
- 3.16 OSHA PEL-Ceiling: 200 ppm
- 3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

- 4.1 Flash Point: 90°F C.C. practically nonflammable
- 4.2 Flammable Limits in Air: 8.0%-10.5%
- 4.3 Fire Extinguishing Agents: Water fog
- 4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
- 4.5 Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations.
- 4.6 Behavior in Fire: Not pertinent
- 4.7 Auto Ignition Temperature: 770°F
- 4.8 Electrical Hazards: Not pertinent
- 4.9 Burning Rate: Not pertinent
- 4.10 Adiabatic Flame Temperature: Currently not available
- 4.11 Stoichiometric Air to Fuel Ratio: 9.5 (calc.)
- 4.12 Flame Temperature: Currently not available
- 4.13 Combustion Molar Ratio (Reactant to Product): 4.0 (calc.)
- 4.14 Minimum Oxygen Concentration for Combustion (MOCC): No diluent: 9.0% at 100°C

5. CHEMICAL REACTIVITY

- 5.1 Reactivity with Water: No reaction
- 5.2 Reactivity with Common Materials: No reaction
- 5.3 Stability During Transport: Stable
- 5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
- 5.5 Polymerization: Not pertinent
- 5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

- 6.1 Aquatic Toxicity: 680 mg/40 hr/daphnia/dl/fresh water
- 6.2 Waterfowl Toxicity: Currently not available
- 6.3 Biological Oxygen Demand (BOD): Currently not available
- 6.4 Food Chain Concentration Potential: None
- 6.5 GESAMP Hazard Profile: Bioaccumulation: Damage to living resources: Human Oral hazard: Reduction of amenities:

7. SHIPPING INFORMATION

- 7.1 Grades of Purity: Technical; dry cleaning; degreasing; extraction
- 7.2 Storage Temperature: Ambient
- 7.3 Inert Atmosphere: No requirement
- 7.4 Venting: Pressure-vacuum
- 7.5 IMO Pollution Category: C
- 7.6 Ship Type: 3
- 7.7 Barge Hull Type: 3

8. HAZARD CLASSIFICATIONS

- 8.1 49 CFR Category: Keep Away From Food
- 8.2 49 CFR Class: 6.1
- 8.3 49 CFR Package Group: III
- 8.4 Marine Pollutant: No
- 8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	1
Instability (Yellow).....	0
- 8.6 EPA Reportable Quantity: 100 pounds
- 8.7 EPA Pollution Category: B
- 8.8 RCRA Waste Number: U228
- 8.9 EPA FWPCA List: Yes

9. PHYSICAL & CHEMICAL PROPERTIES

- 9.1 Physical State at 15° C and 1 atm: Liquid
- 9.2 Molecular Weight: 131.39
- 9.3 Boiling Point at 1 atm: 189°F = 87°C = 360°K
- 9.4 Freezing Point: -123.5°F = -88.4°C = 188.8°K
- 9.5 Critical Temperature: Not pertinent
- 9.6 Critical Pressure: Not pertinent
- 9.7 Specific Gravity: 1.46 at 20°C (liquid)
- 9.8 Liquid Surface Tension: 29.3 dynes/cm = 0.0293 N/m at 20°C
- 9.9 Liquid Water Interfacial Tension: 34.5 dynes/cm = 0.0345 N/m at 24°C
- 9.10 Vapor (Gas) Specific Gravity: 4.5
- 9.11 Ratio of Specific Heats of Vapor (Gas): 1.116
- 9.12 Latent Heat of Vaporization: 103 Btu/lb = 57.2 cal/g = 2.4 X 10⁴ J/kg
- 9.13 Heat of Combustion: Not pertinent
- 9.14 Heat of Decomposition: Not pertinent
- 9.15 Heat of Solution: Not pertinent
- 9.16 Heat of Polymerization: Not pertinent
- 9.17 Heat of Fusion: Currently not available
- 9.18 Limiting Value: Currently not available
- 9.19 Reid Vapor Pressure: 2.5 psia

NOTES

TRICHLOROETHYLENE

TCL

9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
0	94.669	0	0.220		N	15	0.800
5	94.410	10	0.221		O	20	0.775
10	94.150	20	0.223		T	25	0.750
15	93.889	30	0.225			30	0.727
20	93.629	40	0.228		P	35	0.705
25	93.370	50	0.228		E	40	0.684
30	93.110	60	0.230		R	45	0.664
35	92.849	70	0.231		T	50	0.645
40	92.589	80	0.233		I	55	0.627
45	92.330	90	0.235		N	60	0.610
50	92.070	100	0.238		E	65	0.593
55	91.809	110	0.238		N	70	0.577
60	91.549	120	0.240		T	75	0.562
65	91.290	130	0.241			80	0.548
70	91.030	140	0.243			85	0.534
75	90.770	150	0.245			90	0.521
80	90.509	160	0.246			95	0.508
85	90.250	170	0.248			100	0.496
90	89.990					105	0.485
95	89.730					110	0.474
100	89.469					115	0.463
105	89.209					120	0.453
110	88.950						
115	88.690						
120	88.429						
125	88.169						

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
77	0.110	40	0.508	40	0.01245	0	0.136
		50	0.678	50	0.01628	25	0.139
		60	0.894	60	0.02105	50	0.143
		70	1.186	70	0.02695	75	0.146
		80	1.507	80	0.03419	100	0.149
		90	1.929	90	0.04298	125	0.152
		100	2.448	100	0.05354	150	0.155
		110	3.081	110	0.06619	175	0.157
		120	3.846	120	0.08120	200	0.160
		130	4.765	130	0.09891	225	0.162
		140	5.862	140	0.11960	250	0.165
		150	7.183	150	0.14380	275	0.167
		160	8.695	160	0.17180	300	0.169
		170	10.490	170	0.20390	325	0.172
		180	12.580	180	0.24080	350	0.174
		190	15.010	190	0.28280	375	0.176
		200	17.810	200	0.33040	400	0.177
		210	21.020	210	0.38420	425	0.179
						450	0.181
						475	0.182
						500	0.184
						525	0.185
						550	0.186
						575	0.187
						600	0.188

1,1,2-TRICHLOROETHANE

TCM

CAUTIONARY RESPONSE INFORMATION

Common Synonyms Ethane, 1,1,2-trichloro- bata-trichloroethane Vinyl trichloride	Liquid Colorless Sweet, chloroform like odor Sinks in water.
<p>KEEP PEOPLE AWAY. AVOID CONTACT WITH LIQUID AND VAPOR. Wear self-contained positive pressure breathing apparatus and full protective clothing. Shut off ignition sources and call fire department. Evacuate area in case of large discharge. Stay upwind and use water spray to "knock down" vapor. Notify local health and pollution control agencies. Protect water intakes.</p>	
Fire	<p>POISONOUS GASES ARE PRODUCED IN FIRE. Container may explode in fire. Wear self-contained positive pressure breathing apparatus, impervious clothing and gloves. Extinguish fires with water spray, fog or foam, carbon dioxide, or dry chemical.</p>
Exposure	<p>CALL FOR MEDICAL AID.</p> <p>VAPOR Irritating to eyes, nose, throat, lungs and skin; may cause defolting dermatitis. Highly toxic; death may result from respiratory failure. If inhaled, anesthetic or narcotic effect may occur. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Irritating to skin and eyes; severe irritant to gastrointestinal tract. Highly toxic. If swallowed, may cause liver or kidney damage and may increase myocardial irritability. May cause chemical pneumonitis if aspirated into lungs. IF IN EYES OR ON SKIN, hold eyelids open and flush with water for at least 15 minutes; hold eyelids open if necessary. Remove and isolate contaminated clothing and shoes at the site. IF SWALLOWED, and victim is CONSCIOUS, have victim drink water and induce vomiting. IF SWALLOWED AND VICTIM UNCONSCIOUS OR HAVING CONVULSIONS, just keep victim warm.</p>
Water Pollution	<p>HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.</p>

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Contain
Collection Systems: Pump/Drudge

2. CHEMICAL DESIGNATIONS

- 2.1 CG Compatibility Group: 3; Halogenated hydrocarbon
- 2.2 Formula: $\text{CHCl}_2\text{CH}_2\text{Cl}$
- 2.3 HAZARD Designations: Currently not available
- 2.4 DOT ID No.: Not listed
- 2.5 CAS Registry No.: 79-00-5
- 2.6 NAERG Guide No.: Not listed
- 2.7 Standard Industrial Trade Classification: 81134

3. HEALTH HAZARDS

- 3.1 Personal Protective Equipment: Self-contained positive pressure breathing apparatus and full protective clothing.
- 3.2 Symptoms Following Exposure: Inhalation causes irritation of the nose, throat, and lungs. High concentrations may cause death by respiratory failure. Highly toxic by ingestion; may cause liver or kidney damage or myocardial irritability. Causes severe irritation of the gastrointestinal tract. Vapor may produce superficial skin burns or defolting type dermatitis and may irritate the eyes.
- 3.3 Treatment of Exposures: **INHALATION:** Move to fresh air; call emergency medical care. If breathing stops, give artificial respiration. If breathing is difficult, give oxygen. **INGESTION:** If victim is conscious get victim to induce vomiting by touching the back of the throat with his finger or by taking syrup of Ipecac. If victim is unconscious or having convulsions, do nothing except keep victim warm. **EYES OR SKIN:** Flush with running water for at least 15 minutes; hold eyelids open if necessary. Clean skin with soap or mild detergent. Remove and isolate contaminated clothing and shoes at the site.
- 3.4 TLV-TWA: 10 ppm (skin)
- 3.5 TLV-STEL: Not listed.
- 3.6 TLV-Ceiling: Not listed.
- 3.7 Toxicity by Ingestion: Grade 2; LD₅₀ = 580 mg/kg (rat)
- 3.8 Toxicity by Inhalation: Currently not available.
- 3.9 Chronic Toxicity: Causes liver and kidney damage; may increase myocardial irritability. It is a central nervous system depressant. It is carcinogenic. May cause chemical pneumonitis if aspirated into the lungs.
- 3.10 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will not tolerate moderate or high concentrations.
- 3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on skin and allowed to remain, may cause smarting and reddening of the skin.
- 3.12 Odor Threshold: Currently not available
- 3.13 IDLH Value: 100 ppm (skin)
- 3.14 OSHA PEL-TWA: 10 ppm (skin)
- 3.15 OSHA PEL-STEL: Not listed.
- 3.16 OSHA PEL-Ceiling: Not listed.
- 3.17 EPA AEGL: Not listed

4. FIRE HAZARDS

- 4.1 Flash Point: None.
- 4.2 Flammable Limits in Air: 8.4% - 13.3%
- 4.3 Fire Extinguishing Agents: Small fires: dry chemical or CO₂. Large fires: water spray, fog or foam.
- 4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
- 4.5 Special Hazards of Combustion Products: Toxic gases including hydrogen chloride and very small amounts of phosgene and chlorine are produced.
- 4.6 Behavior in Fire: Forms a flammable vapor-air mixture at 109°F and higher.
- 4.7 Auto Ignition Temperature: Not pertinent
- 4.8 Electrical Hazards: Currently not available
- 4.9 Burning Rate: Currently not available
- 4.10 Adiabatic Flame Temperature: Currently not available
- 4.11 Stoichiometric Air to Fuel Ratio: 9.5 (calc.)
- 4.12 Flame Temperature: Currently not available
- 4.13 Combustion Molar Ratio (Reactant to Product): 5.0 (calc.)
- 4.14 Minimum Oxygen Concentration for Combustion (MOC): Not listed

5. CHEMICAL REACTIVITY

- 5.1 Reactivity with Water: No reaction
- 5.2 Reactivity with Common Materials: Incompatible with oxidizing material or aluminum. Will attack some forms of plastics, rubber and coatings.
- 5.3 Stability During Transport: Stable
- 5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
- 5.5 Polymerization: Not pertinent
- 5.6 Inhibitor of Polymerization: Not pertinent

6. WATER POLLUTION

- 6.1 Aquatic Toxicity: 18 mg/48 hradsphtha magna/LC/fresh water.
- 6.2 Waterfowl Toxicity: Currently not available
- 6.3 Biological Oxygen Demand (BOD): Currently not available
- 6.4 Food Chain Concentration Potential: Currently not available
- 6.5 GESAMP Hazard Profile: Bioaccumulation: 0
Damage to living resources: 2
Human Oral hazard: 1
Human Contact hazard: 0
Reduction of amenities: 0

7. SHIPPING INFORMATION

- 7.1 Grades of Purity: Technical grade; stabilized; 95%
- 7.2 Storage Temperature: Currently not available
- 7.3 Inert Atmosphere: Currently not available
- 7.4 Venting: Currently not available
- 7.5 IMO Pollution Category: C
- 7.6 Ship Type: 3
- 7.7 Barge Hull Type: 3

8. HAZARD CLASSIFICATIONS

- 8.1 49 CFR Category: Not listed
- 8.2 49 CFR Class: Not pertinent
- 8.3 49 CFR Package Group: Not listed
- 8.4 Marine Pollutant: No
- 8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	1
Instability (Yellow)	0
- 8.6 EPA Reportable Quantity: 100 pounds
- 8.7 EPA Pollution Category: B
- 8.8 RCRA Waste Number: U227
- 8.9 EPA FWPCL List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

- 9.1 Physical State at 18° C and 1 atm: Liquid
- 9.2 Molecular Weight: 133.41
- 9.3 Boiling Point at 1 atm: 236.6°F = 113.7°C = 386.9°K
- 9.4 Freezing Point: -31/-34.1°F = -35/-38.7°C = 238.2/238.5°K
- 9.5 Critical Temperature: Currently not available
- 9.6 Critical Pressure: Currently not available
- 9.7 Specific Gravity: 1.44 at 20°C (liquid)
- 9.8 Liquid Surface Tension: 33.73 dynes/cm = 0.0338 Nm at 20°C
- 9.9 Liquid Water Interfacial Tension: Currently not available
- 9.10 Vapor (Gas) Specific Gravity: 4.8
- 9.11 Ratio of Specific Heats of Vapor (Gas): Currently not available
- 9.12 Latent Heat of Vaporization: Currently not available
- 9.13 Heat of Combustion: Currently not available
- 9.14 Heat of Decomposition: Not pertinent
- 9.15 Heat of Solution: Not pertinent
- 9.16 Heat of Polymerization: Not pertinent
- 9.17 Heat of Fusion: Currently not available
- 9.18 Limiting Value: Currently not available
- 9.19 Reid Vapor Pressure: Currently not available

NOTES

1,1,2-TRICHLOROETHANE

TCM

9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
68	89.300		C U R R E N T L Y N O T A V A I L A B L E		C U R R E N T L Y N O T A V A I L A B L E		C U R R E N T L Y N O T A V A I L A B L E

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	I M S O L U B L E	0 25 50 75 100 125 150 175 200	0.048 0.083 0.178 0.344 0.660 1.285 2.427 4.658 8.933	0 25 50 75 100 125 150 175 200	0.09130 0.00239 0.00439 0.00885 0.01478 0.02712 0.04876 0.09130 0.16753		C U R R E N T L Y N O T A V A I L A B L E

TETRACHLOROETHYLENE

TTE

CAUTIONARY RESPONSE INFORMATION

Common Synonyms Perchloroethylene Perclene Park Tetracap	Watery liquid Colorless Sweet odor Sinks in water. Irritating vapor is produced.
Avoid contact with liquid and vapor. Notify local health and pollution control agencies. Protect water intakes.	
Fire	Not flammable. Poisonous gases are produced when heated.
Exposure	CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose and throat. If inhaled, will cause difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
	Water Pollution Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
 Contain
 Collection Systems: Pump
 Clean shore line

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Group: Not listed.
 2.2 Formula: $\text{Cl}_2\text{C}=\text{CCl}_2$
 2.3 ISOAUN Designation: 9.01897
 2.4 DOT ID No.: 1697
 2.5 CAS Registry No.: 127-18-4
 2.6 NAERG Guide No.: 100
 2.7 Standard Industrial Trade Classification: 51133

3. HEALTH HAZARDS

- 3.1 Personal Protective Equipment: For high vapor concentrations use approved canister or air-supplied mask; chemical goggles or face shield; plastic gloves.
- 3.2 Symptoms Following Exposure: Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury.
- 3.3 Treatment of Exposure: **INHALATION:** If illness occurs, remove patient to fresh air; keep him warm and quiet, and get medical attention. **INGESTION:** Induce vomiting only on physician's recommendation. **EYES AND SKIN:** Flush with plenty of water and get medical attention if irritation or injury occurs.
- 3.4 TLV-TWA: 25 ppm
- 3.5 TLV-STEL: 100 ppm
- 3.6 TLV-Celling: Not listed.
- 3.7 Toxicity by Ingestion: Grade 2; $\text{LD}_{50} = 0.5$ to 5 g/kg
- 3.8 Toxicity by Inhalation: Currently not available.
- 3.9 Chronic Toxicity: None
- 3.10 Vapor (Gas) Irritant Characteristics: Vapors cause a slight smarting of the eyes or throat if present in high concentrations. The effect is temporary.
- 3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
- 3.12 Odor Threshold: 5 ppm
- 3.13 IDLH Values: 150 ppm
- 3.14 OSHA PEL-TWA: 100 ppm
- 3.15 OSHA PEL-STEL: 300 ppm, 5 minute peak in any 3 hours
- 3.16 OSHA PEL-Celling: 200 ppm
- 3.17 EPA ABOL: Not listed

4. FIRE HAZARDS

- 4.1 Flash Point: Not flammable
- 4.2 Flammable Limits in Air: Not flammable
- 4.3 Fire Extinguishing Agents: Not pertinent
- 4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
- 4.5 Special Hazards of Combustion: Product: Toxic, irritating gases may be generated in fires.
- 4.6 Behavior in Fire: Not pertinent
- 4.7 Auto Ignition Temperature: Not flammable
- 4.8 Electrical Hazards: Not pertinent
- 4.9 Burning Rate: Not flammable
- 4.10 Adiabatic Flame Temperature: Currently not available
- 4.11 Stoichiometric Air to Fuel Ratio: Not pertinent
- 4.12 Flame Temperature: Currently not available
- 4.13 Combustion Motor Ratio (Reactant to Product): Not pertinent.
- 4.14 Minimum Oxygen Concentration for Combustion (MOCC): Not listed

5. CHEMICAL REACTIVITY

- 5.1 Reactivity with Water: No reaction
- 5.2 Reactivity with Common Materials: No reaction
- 5.3 Stability During Transport: Stable
- 5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
- 5.5 Polymerizations: Not pertinent
- 5.6 Inhibitor of Polymerizations: Not pertinent

6. WATER POLLUTION

- 6.1 Aquatic Toxicity: Currently not available
- 6.2 Waterford Toxicity: Currently not available
- 6.3 Biological Oxygen Demand (BOD): None
- 6.4 Food Chain Concentration Potential: None
- 6.5 GESAMP Hazard Profile: Not listed

7. SHIPPING INFORMATION

- 7.1 Grades of Purity: Dry cleaning and industrial grades: 95+%
- 7.2 Storage Temperature: Ambient
- 7.3 Inert Atmosphere: No requirement
- 7.4 Venting: Pressure-vacuum
- 7.5 IMO Pollution Category: 8
- 7.6 Ship Type: 3
- 7.7 Barge Hull Type: 3

8. HAZARD CLASSIFICATIONS

- 8.1 49 CFR Category: Keep Away From Food
- 8.2 49 CFR Class: 8.1
- 8.3 49 CFR Package Group: III
- 8.4 Marine Pollutant: Yes
- 8.5 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	0
Instability (Yellow)	0
- 8.6 EPA Reportable Quantity: 100 pounds
- 8.7 EPA Pollution Category: 8
- 8.8 RCRA Waste Number: U210/O039
- 8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

- 9.1 Physical State at 18° C and 1 atm: Liquid
- 9.2 Molecular Weight: 165.83
- 9.3 Boiling Point at 1 atm: 250°F = 121°C = 394°K
- 9.4 Freezing Point: -8.3°F = -22.4°C = 250.8°K
- 9.5 Critical Temperature: 658.6°F = 347°C = 620.2°K
- 9.6 Critical Pressure: Not pertinent
- 9.7 Specific Gravity: 1.63 at 20°C (liquid)
- 9.8 Liquid Surface Tension: 31.3 dynes/cm = 0.0313 N/m at 20°C
- 9.9 Liquid Water Interfacial Tension: 44.4 dynes/cm = 0.0444 N/m at 25°C
- 9.10 Vapor (Gas) Specific Gravity: Not pertinent
- 9.11 Ratio of Specific Heats of Vapor (Gas): 1.116
- 9.12 Latent Heat of Vaporization: 90.2 Btu/lb = 50.1 cal/g = 2.10×10^4 J/kg
- 9.13 Heat of Combustion: Not pertinent
- 9.14 Heat of Decomposition: Not pertinent
- 9.15 Heat of Solution: Not pertinent
- 9.16 Heat of Polymerization: Not pertinent
- 9.17 Heat of Fusion: Currently not available
- 9.18 Limiting Value: Currently not available
- 9.19 Reid Vapor Pressure: Currently not available

NOTES

TETRACHLOROETHYLENE

TTE

9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit (inch per hour-square foot-F	Temperature (degrees F)	Centipoise
35	103.400	0	0.198		N	55	0.958
40	103.099	10	0.200		O	60	0.929
45	102.900	20	0.201		T	65	0.908
50	102.598	30	0.202			70	0.873
55	102.299	40	0.203		P	75	0.848
60	102.000	50	0.204		E	80	0.823
65	101.700	60	0.205		R	85	0.808
70	101.400	70	0.206		T	90	0.777
75	101.080	80	0.207		I	95	0.756
80	100.789	90	0.208		N	100	0.736
85	100.500	100	0.210		E	105	0.716
90	100.208	110	0.211		N	110	0.698
95	99.910	120	0.212		T	115	0.689
100	99.610	130	0.213			120	0.663
105	99.320	140	0.214			125	0.647
110	99.020	150	0.215			130	0.631
115	98.730	160	0.216			135	0.616
120	98.429	170	0.217			140	0.601
125	98.138	180	0.218			145	0.588
130	97.839	190	0.220			150	0.574
135	97.540	200	0.221			155	0.561
140	97.250	210	0.222			160	0.548
145	96.959					165	0.537
150	96.668					170	0.526
155	96.370					175	0.515
160	96.080						

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
65	0.016	60	0.238	60	0.00702	0	0.108
		70	0.318	70	0.00929	25	0.110
		80	0.425	80	0.01216	50	0.113
		90	0.561	90	0.01575	75	0.116
		100	0.732	100	0.02022	100	0.118
		110	0.948	110	0.02571	125	0.120
		120	1.217	120	0.03242	150	0.122
		130	1.548	130	0.04055	175	0.125
		140	1.953	140	0.05032	200	0.127
		150	2.448	150	0.06195	225	0.129
		160	3.042	160	0.07583	250	0.131
		170	3.756	170	0.09218	275	0.132
		180	4.607	180	0.11139	300	0.134
		190	5.616	190	0.13380	325	0.136
		200	6.803	200	0.15946	350	0.138
		210	8.199	210	0.18910	375	0.139
		220	9.824	220	0.22330	400	0.141
		230	11.710	230	0.26230	425	0.142
		240	13.896	240	0.30680	450	0.143
		250	16.390	250	0.35680	475	0.144
		260	19.280	260	0.41330	500	0.146
		270	22.520	270	0.47680	525	0.147
		280	26.230	280	0.54790	550	0.148
						575	0.148
						600	0.149

VINYL CHLORIDE

VCM

CAUTIONARY RESPONSE INFORMATION

Common Synonyms	Gas	Colorless	Sweet odor
Chloroethylene VCL VCM Vinyl C monomer	Liquid flocks and balls on water. Flammable, irritating visible vapor cloud is produced.		
<p>Keep people away. Evacuate. Shut off ignition sources and call fire department. Stay upwind and use water spray to "knock down" vapor. Evacuate area in case of large discharge. Avoid contact with liquid and vapor. Notify local health and pollution control agencies. Protect water intakes.</p>			
Fire	<p>FLAMMABLE. POISONOUS GAS IS PRODUCED IN FIRE. Flashback along vapor trail may occur. May explode if ignited in an enclosed area. Wear self-contained breathing apparatus. Cool exposed containers and protect men effecting shut-off with water. Stop flow of gas if possible. Let fire burn. Extinguish small fires with dry chemical.</p>		
Exposure	<p>CALL FOR MEDICAL AID. VAPOR Irritating to eyes, nose, and throat. If inhaled, will cause dizziness or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen.</p> <p>LIQUID Will cause frostbite. Flush affected areas with plenty of water. DO NOT RUB AFFECTED AREAS.</p> <p>Not harmful to aquatic life.</p>		
Water Pollution			

1. CORRECTIVE RESPONSE ACTIONS	2. CHEMICAL DESIGNATIONS
<p>Close and dampen Stop discharge</p>	<p>2.1 CG Compatibility Groups: 35; Vinyl halides 2.2 Formulas: CH₂=CHCl 2.3 MSDS Designations: 2.01088 2.4 DOT ID No.: 1088 2.5 CAS Registry No.: 75-01-4 2.6 NAHRO Guide No.: 11GP 2.7 Standard Industrial Trade Classifications: 31139</p>
3. HEALTH HAZARDS	
<p>3.1 Personal Protective Equipment: Rubber gloves and shoes; gas-tight goggles; organic vapor canister or self-contained breathing apparatus. 3.2 Symptoms Following Exposure: INHALATION: High concentrations cause dizziness, anesthesia, lung irritation. SKIN: may cause frostbite; phenol inhibitor may be absorbed through skin if large amounts of liquid evaporate. 3.3 Treatment of Exposure: INHALATION: remove patient to fresh air and keep him quiet and warm; call a doctor; give artificial respiration if breathing stops. EYES AND SKIN: flush with plenty of water for at least 15 min.; for eyes, get medical attention; remove contaminated clothing. 3.4 TLV-TWA: 5 ppm 3.5 TLV-STEL: Not listed. 3.6 Toxicity by Ingestion: Not pertinent. 3.7 Toxicity by Inhalation: Currently not available. 3.8 Chronic Toxicity: Chronic exposure may cause liver damage. 3.10 Vapor (Gas) Irritant Characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary. 3.11 Liquid or Solid Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smearing and reddening of skin. May cause frostbite. 3.12 Odor Threshold: 200 ppm 3.13 IDLH Value: Not listed. 3.14 OSHA PEL-TWA: 1 ppm 3.15 OSHA PEL-STEL: 5 ppm average not exceeding any 15 min. 3.16 OSHA PEL-Celling: Not listed. 3.17 EPA AEGGL: Not listed</p>	

4. FIRE HAZARDS

- 4.1 Flash Point: -110°F O.C.
- 4.2 Flammable Limits in Air: 3.6 - 33%
- 4.3 Fire Extinguishing Agents: For small fires use dry chemical or carbon dioxide. For large fires stop flow of gas. Cool exposed containers with water.
- 4.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
- 4.5 Special Hazards of Combustion Products: Forms highly toxic combustion products such as hydrogen chloride, phosgene, and carbon monoxide.
- 4.6 Behavior in Fire: Container may explode in fire. Gas is heavier than air and may travel considerable distance to a source of ignition and flash back.
- 4.7 Auto Ignition Temperature: 882°F
- 4.8 Electrical Hazard: Class I, Group D
- 4.9 Burning Rate: 4.3 mm/min.
- 4.10 Adiabatic Flame Temperature: Currently not available
- 4.11 Stoichiometric Air to Fuel Ratio: 11.9 (calc.)
- 4.12 Flame Temperature: Currently not available
- 4.13 Combustion Heat Ratio (Relevant to Product): 4.0 (calc.)
- 4.14 Minimum Oxygen Concentration for Combustion (MOC): No data; 10.0-12.4%

5. CHEMICAL REACTIVITY

- 5.1 Reactivity with Water: No reaction
- 5.2 Reactivity with Common Materials: No reaction
- 5.3 Stability During Transport: Stable
- 5.4 Neutralizing Agents for Acids and Caustics: Not pertinent
- 5.5 Polymerization: Polymerizes in presence of air, sunlight, or heat unless stabilized by inhibitors.
- 5.6 Inhibitor of Polymerization: Not normally used except when high temperatures are expected. Then 40-100 ppm of phenol used.

6. WATER POLLUTION

- 6.1 Aquatic Toxicity: None
- 6.2 Waterway Toxicity: None
- 6.3 Biological Oxygen Demand (BOD): None
- 6.4 Food Chain Concentration Potential: None
- 6.5 GESAMP Hazard Profile: Bioaccumulation: 0
Damage to living resources: MA
Human Oral hazard: MA
Human Contact hazard: II
Reduction of aesthetics: XXX

7. SHIPPING INFORMATION

- 7.1 Grades of Purity: Commercial or technical 99+%
- 7.2 Storage Temperature: Under pressure; ambient At atm. pressure; low
- 7.3 Inert Atmosphere: No requirement
- 7.4 Venting: Under pressure; safety relief At atm. pressure; pressure-vacuum
- 7.5 IMO Pollution Category: Currently not available
- 7.6 Ship Type: 2
- 7.7 Barge Hull Type: 2

8. HAZARD CLASSIFICATIONS

- 8.1 48 CFR Category: Flammable gas
- 8.2 48 CFR Class: 2.1
- 8.3 48 CFR Package Group: Not pertinent.
- 8.4 Marine Pollutant: No
- 8.5 NFPA Hazard Classifications:
Category _____
Health Hazard (blue) _____ 2
Flammability (Red) _____ 4
Instability (Yellow) _____ 2
- 8.6 EPA Reportable Quantity: 1 pound
- 8.7 EPA Pollution Category: X
- 8.8 RCRA Waste Number: U043D043
- 8.9 EPA FWPCA List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

- 9.1 Physical State at 19° C and 1 atm: Gas
- 9.2 Molecular Weight: 62.50
- 9.3 Boiling Point at 1 atm: 7.2°F = 13.5°C = 258.4°K
- 9.4 Freezing Point: -244.5°F = -153.9°C = -119.4°K
- 9.5 Critical Temperature: 317.1°F = 158.4°C = 431.8°K
- 9.6 Critical Pressure: 775 psi = 52.7 atm = 5.34 MPa
- 9.7 Specific Gravity: 0.989 at -13°C (liquid)
- 9.8 Liquid Surface Tension: 18.0 dynes/cm = 0.0180 Nm at 25°C
- 9.9 Liquid Water Interfacial Tension: (est.) 30 dynes/cm = 0.03 Nm at 20°C
- 9.10 Vapor (Gas) Specific Gravity: 2.2
- 9.11 Ratio of Specific Heats of Vapor (Gas): 1.188
- 9.12 Latent Heat of Vaporization: 160 Btu/lb = 88 cal/g = 3.7 X 10³ J/kg
- 9.13 Heat of Combustion: -8138 Btu/lb = -4320 cal/g = -181.1 X 10³ J/kg
- 9.14 Heat of Decomposition: Not pertinent
- 9.15 Heat of Solution: Not pertinent
- 9.16 Heat of Polymerization: -729 Btu/lb = -405 cal/g = 16.9 X 10³ J/kg
- 9.17 Heat of Fusion: 18.14 cal/g
- 9.18 Limiting Value: Currently not available
- 9.19 Reid Vapor Pressure: 75 psia

NOTES

VINYL CHLORIDE

VCM

9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
0	61.500	-38	0.259		N O T P E R T I N E N T	-10	0.287
5	60.710	-20	0.265			-5	0.281
		-10	0.272			0	0.276
		0	0.279			5	0.271

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
62	0.800	-58	3.384	-58	0.04810	0	0.185
		-48	4.501	-48	0.06245	25	0.192
		-38	5.938	-38	0.08005	50	0.198
		-28	7.558	-28	0.10146	75	0.205
		-18	9.314	-18	0.12710	100	0.211
		8	12.448	0	0.15780	125	0.217
		18	15.910	10	0.19366	150	0.224
		28	19.710	20	0.23580	175	0.230
		38	23.920	30	0.28440	200	0.235
		48	28.320	40	0.34050	225	0.241
		58	33.430	50	0.40470	250	0.247
		68	42.830	60	0.47760	275	0.252
		78	55.940	70	0.56000	300	0.257
		88	68.488	80	0.65250	325	0.263
		98	71.348	90	0.75570	350	0.268
		108	83.688	100	0.87050	375	0.273
		118	97.580	110	0.99740	400	0.277
		128	113.208	120	1.13700	425	0.282
						450	0.286
						475	0.291
						500	0.295
						525	0.299
						550	0.303
						575	0.307
						600	0.311

1,2-DICHLOROETHYLENE

DEL

CAUTIONARY RESPONSE INFORMATION

Common Synonyms Acetylene dichloride trans-1,2-Dichloroethylene cis-1,2-Dichloroethylene sym-Dichloroethylene Dichlorom	Liquid	Colorless	Sweet pleasant odor
Sinks in water. Flammable, irritating vapor is produced.			
Evacuate. Keep people away. Wear goggles and self-contained breathing apparatus. Shut off ignition sources. Call fire department. Notify local health and pollution control agencies. Protect water intakes.			
Fire	FLAMMABLE POISONOUS GASES MAY BE PRODUCED IN FIRE. Containers may explode in fire. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemicals, foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.		
Exposure	Call for medical aid. VAPOR If inhaled will cause dizziness, nausea, vomiting, or difficult breathing. Move victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. LIQUID Harmful if swallowed. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.		
Water Pollution			

1. CORRECTIVE RESPONSE ACTIONS

Stop discharge
Collection Systems: Pump
Collection Systems: Dredge
Do not burn

2. CHEMICAL DESIGNATIONS

2.1 CG Compatibility Groups: Not listed.
2.2 Reactives: CCH₂ + CH₂
2.3 INCHLIM Chemical: 3.2/1150
2.4 DOT ID No.: 1150
2.5 CAS Registry No.: 540-59-0
2.6 MAERG Guide No.: 1329
2.7 Standard Industrial Trade Classification: 51128

3. HEALTH HAZARDS

3.1 Personal Protective Equipment: Rubber gloves; safety goggles; air supply mask or self-contained breathing apparatus.
3.2 Symptoms Following Exposure: Irritation causes nausea, vomiting, weakness, tremor, epigastric cramps, general nervous depression. Contact with liquid causes irritation of eyes and (on prolonged contact) skin. Ingestion causes slight depression to deep narcosis.
3.3 Treatment of Exposure: INHALATION: remove from further exposure; if breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration, preferably mouth-to-mouth; give oxygen when breathing is resumed; call a physician. EYES: Flush with water for at least 15 min. SKIN: Wash well with soap and water. INGESTION: Give gastric lavage and cathartics.
3.4 TLV-TWA: 200 ppm
3.5 TLV-STEL: Not listed.
3.6 TLV-Ceiling: Not listed.
3.7 Toxicity by Ingestion: Grade 2; oral LD₅₀ = 770 mg/kg (rat)
3.8 Toxicity by Inhalation: Currently not available.
3.9 Chronic Toxicity: Produces liver and kidney injury in experimental animals.
3.10 Vapor (Gas) Irritant Characteristics: Currently not available.
3.11 Liquid or Solid Characteristics: Currently not available.
3.12 Other Thresholds: Currently not available.
3.13 IDLH Values: 1,000 ppm
3.14 OSHA PEL-TWA: 200 ppm
3.15 OSHA PEL-STEL: Not listed.
3.16 OSHA PEL-Ceiling: Not listed.
3.17 EPA AEGL: Not listed.

4. FIRE HAZARDS

4.1 Flash Point 37°F C.C.
4.2 Flammable Limits in Air: 9.7%-12.8%
4.3 Fire Extinguishing Agents: Dry chemical, foam, carbon dioxide
4.4 Fire Extinguishing Agents Not to Be Used: Water may be ineffective.
4.5 Special Hazards of Combustion Products: Phosgene and hydrogen chloride fumes may form in fire.
4.6 Behavior in Fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.

4.7 Auto Ignition Temperature: 800°F
4.8 Electrical Hazards: Currently not available

4.9 Burning Rate: 2.6 mm/min.

4.10 Adiabatic Flame Temperature: Currently not available

4.11 Stoichiometric Air to Fuel Ratio: 9.5 (calc.)

4.12 Flame Temperature: Currently not available

4.13 Combustion Heat Ratio (Resistant to Product): 4.0 (calc.)

4.14 Minimum Oxygen Concentration for Combustion (MOC): Not listed

5. CHEMICAL REACTIVITY

5.1 Reactivity with Water: No reaction
5.2 Reactivity with Common Materials: No reaction

5.3 Stability During Transport: Stable

5.4 Neutralizing Agents for Acids and Alkalies: Not pertinent

5.5 Polymerization: Will not occur under ordinary conditions of shipment. The reaction is not vigorous.

5.6 Inhibitor of Polymerization: None used

6. WATER POLLUTION

6.1 Aquatic Toxicity: Currently not available

6.2 Waterflow Toxicity: Currently not available

6.3 Biological Oxygen Demand (BOD): Currently not available

6.4 Food Chain Concentration Potential: None

6.5 QESAMP Hazard Profile: Bioaccumulation: 0

Damage to living resources: 1

Human Oral hazard: 1

Reduction of antibiotic: X

7. SHIPPING INFORMATION

7.1 Grades of Purity: Commercial
7.2 Storage Temperature: Ambient
7.3 Inert Atmosphere: No requirement
7.4 Venting: Pressure-vacuum
7.5 IMO Pollution Category: Currently not available
7.6 Ship Type: Currently not available
7.7 Barge Hull Type: Currently not available

8. HAZARD CLASSIFICATIONS

8.1 49 CFR Category: Flammable liquid

8.2 49 CFR Class: 3

8.3 49 CFR Package Group: II

8.4 Marine Pollutant: No

8.5 NFPA Hazard Classifications:

Category: _____

Health Hazard (Blue): _____ 2

Flammability (Red): _____ 3

Instability (Yellow): _____ 2

8.6 EPA Reportable Quantity: 1000 pounds

8.7 EPA Pollution Category: C

8.8 RCRA Waste Number: U079

8.9 EPA PWPCL List: Not listed

9. PHYSICAL & CHEMICAL PROPERTIES

9.1 Physical State at 15° C and 1 atm: Liquid

9.2 Molecular Weight: 97.0

9.3 Boiling Point at 1 atm: 140°F = 60°C = 333°K (est.) 116°F = 45°C = 321°K

9.4 Freezing Point: -114°F = -81°C = 182°K (est.) -50°F = -50°C = 223°K

9.5 Critical Temperature: Not pertinent

9.6 Critical Pressure: Not pertinent

9.7 Specific Gravity: 1.27 at 25°C (liquid)

9.8 Liquid Surface Tension: 24 dynes/cm = 0.024 N/m at 20°C

9.9 Liquid Water Interfacial Tension: (est.) 30 dynes/cm = 0.030 N/m at 20°C

9.10 Vapor (Gas) Specific Gravity: 3.34

9.11 Ratio of Specific Heats of Vapor (Gas): 1.1468

9.12 Latent Heat of Vaporization: 130 Btu/lb = 72 cal/g = 3.0 X 10⁵ J/kg

9.13 Heat of Combustion: -4,847.2 Btu/lb = -2,682.9 cal/g = -112.67 X 10³ J/kg

9.14 Heat of Decomposition: Not pertinent

9.15 Heat of Solution: Not pertinent

9.16 Heat of Polymerization: Not pertinent

9.17 Heat of Fusion: Currently not available

9.18 Limiting Values: Currently not available

9.19 Reid Vapor Pressure: Currently not available

NOTES

1,2-DICHLOROETHYLENE

DEL

9.20 SATURATED LIQUID DENSITY		9.21 LIQUID HEAT CAPACITY		9.22 LIQUID THERMAL CONDUCTIVITY		9.23 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit inch per hour-square foot-F	Temperature (degrees F)	Centipoise
35	81.020	35	0.183	65	0.507	40	0.478
40	80.820	40	0.186	70	0.484	50	0.454
45	80.610	45	0.188	75	0.482	60	0.432
50	80.400	50	0.200	80	0.469	70	0.411
55	80.180	55	0.202	85	0.457	80	0.393
60	79.960	60	0.204	90	0.444	90	0.376
65	79.750	65	0.207	95	0.432	100	0.360
70	79.570	70	0.209	100	0.418	110	0.345
75	79.360	75	0.216	105	0.407	120	0.331
80	79.150	80	0.213	110	0.394	130	0.318
85	78.940	85	0.216	115	0.382	140	0.307
90	78.740	90	0.218	120	0.369	150	0.296
95	78.530	95	0.220	125	0.357	160	0.286
100	78.320	100	0.222	130	0.344	170	0.276
105	78.110	105	0.224			180	0.267
110	77.900	110	0.227			190	0.259
115	77.690	115	0.229			200	0.251
120	77.490	120	0.231			210	0.244
125	77.280	125	0.233				
130	77.070	130	0.236				
135	76.860	135	0.238				
140	76.650	140	0.240				

9.24 SOLUBILITY IN WATER		9.25 SATURATED VAPOR PRESSURE		9.26 SATURATED VAPOR DENSITY		9.27 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
60	0.830	55	3.009	55	0.05284	0	0.150
		60	3.296	60	0.05906	20	0.183
		65	3.624	65	0.06587	40	0.198
		70	4.287	70	0.07330	60	0.159
		75	4.817	75	0.08141	80	0.182
		80	5.389	80	0.09023	100	0.185
		85	6.016	85	0.09880	120	0.187
		90	6.702	90	0.11020	140	0.170
		95	7.433	95	0.12140	160	0.173
		100	8.272	100	0.13360	180	0.178
		105	9.164	105	0.14660	200	0.179
		110	10.130	110	0.16070	220	0.182
		115	11.190	115	0.17590	240	0.185
		120	12.330	120	0.19220	260	0.188
		125	13.560	125	0.20960	280	0.191
		130	14.900	130	0.22830	300	0.194
		135	16.340	135	0.24820	320	0.197
		140	17.890	140	0.26960	340	0.200
						360	0.203
						380	0.206
						400	0.208
						420	0.211
						440	0.214

ATTACHMENT C

LOCK OUT / TAG OUT ACKNOWLEDGEMENT FORMS

Lock Out / Tag Out Acknowledgement

TRS has trained me in the proper procedures to shut off the SPH power supply, open the power supply disconnect, lock the disconnect open, and danger tag the lock. I agree to abide by the lock out, tag out requirements described in the HASP. Before removing the disconnect tag and lock, I will personally verify that the field is in a safe condition for start-up and that all access keys have been returned to the key storage box.

signature	signature of TRS trainer	date
signature	signature of TRS trainer	date
signature	signature of TRS trainer	date
signature	signature of TRS trainer	date
signature	signature of TRS trainer	date
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